UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
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REPORT AND RECOMMENDATIONS
of the
GRAIN AND FORAGE CROPS RESEARCH ADVISORY COMMITTEE
Developed at its Meeting
February 3-7, 1964

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PREFACE

The annual meeting of the Grain and Forage Crops Research Advisory Committee was held in Washington, D. C., February 3-7, 1964, with thirteen of the fifteen members present. The sessions on the first two days were open to the public. During this period, a number of representatives of agricultural and industry organizations, listed below, presented their views concerning research needs:

A. J. LeJeune, Executive Director, Malting Barley Improvement Association
Dr. Roy K. Durham, Consultant, and Howard Morton, Director of Utilization Research, Great Plains Wheat, Inc.
Dr. Betty Sullivan, Member, Technical Advisory Committee, Millers' National Federation
John J. McCracken, Washington Representative, National Corn Growers Association
Kenneth Keneaster, Rice Millers' Association
Dr. Carroll Brunthaver, Director of Research, Grain and Feed Dealers National Association
Richard L. Kathe, Executive Vice President, American Dehydrators Association
William Heckendorn, Executive Secretary, American Seed Trade Association

On the second day there was a tour of Department research facilities at Beltsville.

As a basis for its recommendations and comments, the Committee made a systematic review of the Department's research program for grain, rice, forage, feed, and seed, as summarized in a Progress Report supplied to the Committee in advance of the meeting. The Progress Report material was supplemented by oral reports, visual materials, and discussion by program leaders from the following USDA research divisions and agency units: Crops, Entomology, Agricultural Engineering, Nutrition and Consumer Use, Northern, Southern, and Western Utilization, Market Quality, Transportation and Facilities, Marketing Economics, Farmer Cooperative Service, Economic and Statistical Analysis, and Standards and Research.

Dr. N. C. Brady, Director of Science and Education, served as Chairman, and Dr. H. A. Rodenhiser as Vice Chairman, during the meeting.

After careful review of the information available, and based upon current and future need for new knowledge, and the seriousness of problems faced by the industry, the Committee made the comments and recommendations included in this report to the Secretary of Agriculture.

COMMENTS AND RECOMMENDATIONS

GENERAL

With a continuous world population explosion and a partial breakdown of agricultural production in many parts of the world due to adverse weather conditions and lack of technical competence, the need for more grain and forage research, both basic and applied, is more pressing than is generally recognized. Recurring damage from new diseases, invasions of new insects, and adverse weather in this country forcefully remind us how fast an abundant supply of foods and fibers can be reduced to the point of scarcity if the knowledge necessary to meet such threats is not readily available.

This Committee would like to see greater emphasis on dissemination of information on what the Nation's needs are in terms of feed and fiber for the next ten years. Added to this determination of our domestic needs should be an estimate of the approximate foreign sales insofar as this is possible.

An adequate supply of inexpensive food of top quality is the forerunner and basis of a healthy America. The men of science in agricultural research, working closely with all segments of the grain, seed, and forage industries, are truly the original guardians of the Nation's health. Too often this is momentarily forgotten, because much of what they do demands years of slow, tedious, painstaking work, totally lacking in the sort of glamour that newsmen like to print on the front pages. Greater emphasis should be placed in all news releases on the specific benefits to the public of the findings of applied agricultural research.

The Committee is concerned over the good health of America, but it is more concerned over the failure of the man on the street to recognize or remember that the nation with the best food supply wins international conflicts. Billions are being spent for defense in terms of missiles, space programs, and the like, while less than two percent of the Federal research and development appropriations are being spent for agricultural research--the research that has paid off throughout the history of America in terms of healthy men who won wars.

To keep an alive, aggressive research program growing, and to keep the paying public properly informed, the Grain and Forage Crops Research Advisory Committee feels that a more intensive information program should be carried along with the research work--an information program oriented to the public so that it might understand, support, and appreciate agricultural scientists' work as much as that of scientists in other fields of endeavor. The Committee is pleased to learn of the new approaches along this line being made by the Department to adequately inform the public concerning pesticide problems. It believes, however, that even greater efforts are needed to strengthen information services.

We concur in the recommendation that an Assistant Secretary for Science and Technology be appointed in the Department of Agriculture. It is

urged that congressional action be taken to see that this position be established in the very near future.

The Committee, realizing that the once great gold reserve of this country was contributed to substantially by our exporting agricultural products, would like to see again our products creating anew a favorable balance of trade. But, much more research is needed to bring about the kind of products that are acceptable to the "King" consumer at home and abroad. Available "consumer preferred" feedstuffs, and foodstuffs from other advanced agricultural nations, are now filling markets that could be reopened to the United States. More research on our part is certainly our key to these markets. There are some research tools and facilities available which, because of lack of funds and encouragement, are not being fully utilized. This needs correcting.

Tomorrow's food and fiber needs are going to be much greater than those of today. Some of the things that make a solution of these needs more complex are: greater strains are being put on both the plant and animal kingdoms because each is called on to produce more for less; more virulent strains and new diseases and insect pests are constantly appearing; control measures for diseases, insects, and weeds become increasingly difficult because of fears--wise and otherwise--of residues; new and better varieties of grains and forages are ever needed. Only through more research can adequate answers to these problems be found. We press this point because it takes years to train competent scientists, and working facilities and equipment take time to be built and accumulated.

A negative reaction by the press is sometimes noted when news releases are made concerning new varieties and hybrids of certain crops where surpluses of such crops already exist. Possibly it would be well to add a few lines of information to these releases on the practical aspects and merits of this work.

In this report, the Committee respectfully calls attention to specific areas of the grain and forage work that it feels need attention. Unless there be greater increases in resources allocated to research in the future than there has been in the past, these recommendations are almost in vain. At present, monies available barely enable the various scientists to hold their units together and to continue work on the projects already underway. Sudden influxes of crash programs frequently upset, shelve, or retard today's limited programs.

We concur unanimously with the Department's belief that as funds for new USDA research laboratories are available, these new facilities should be located whenever possible in the close proximity to other existing State and/or Federal research centers and institutions of higher learning, so as to get maximum benefits of existing physical and mental assets.

We are pleased with our scientists' work directed toward orderly disposal of surpluses. With continued efforts in this direction, uses of such products can be expanded, new products be found, and new foreign as well as domestic markets opened up.

The Committee feels that the Department's efforts in development of products and equipment whose value to agriculture will depend upon commercial exploitation need not be brought to the ultimate state of perfection, but should be considered completed as soon as the principal and potential uses have been determined. This would permit Department personnel to undertake developmental work in other areas, and at the same time provide industry with the opportunity to obtain some protection on products it may place on the market, and thus hasten the application of the Department's developments for the benefit of agriculture.

In research now being carried on in the Department of Agriculture, we recognize that all areas of work have many facets. We urge that continued close cooperation be exercised at high levels to get the most out of such research without duplication and waste of manpower. And too, the regular meeting of all minds working on the many problems of such broad fields as transportation, nutrition, etc., should be a tremendous stimulus to those involved and, in the end, hasten conclusions and results to the waiting public.

The Committee urges increased attention to ways of improving coordination among the various phases of closely related research carried on by several organizational units of the Department. Greater awareness of State and industry research programs also is important.

In recommending new or expanded work on the problems listed in this report, the Committee recognizes that it is not its responsibility to delineate between research to be conducted within the Department and that to be conducted in cooperation with State Agricultural Experiment Stations and other research agencies. The recommendations made by the Committee are in terms of the importance of problems on which research is needed and in which the Department should participate.

FARM RESEARCH

The present research effort in Farm Research is making progress and the scientists and administrators should be complimented for the progress to date. The Committee wishes to recognize, however, the need for increased support to facilitate more rapid progress of research programs now under way, and for the initiation of new and pressing work required for the continued growth and health of the industries represented. The requested manpower, material, equipment, and facilities are essential for accomplishment of the programs.

It is also the Committee's considered opinion that highly trained research people should have adequate technical assistance so as to relieve them

for the more exacting requirements of directing the projects for which they are responsible.

The Committee wishes to make the following specific recommendations some of which have been urged in previous Committee reports. For those problems on which some work already is in progress, it should be continued and strengthened or if not yet under way, work should be initiated at the earliest opportunity.

Breeding Grains and Forages

Develop new varieties of wheat with low bromate requirements.

Exploit commercial possibilities of hybrid vigor in wheat through the rapid development of superior varieties.

Develop superior wheat varieties adapted to continuous bread making processes.

Determine genetic factors which contribute to winter hardiness in wheat.

Develop rice varieties with higher protein content.

Develop early maturing long grain rice adapted to various climates and soils in the rice belt of the South and especially in the California areas.

Improve a medium grain rice adapted to California.

Develop corn and sorghum with high xanthophyll and carotene content to improve marketability.

Through appropriate breeding procedures, utilize present knowledge on genetic inheritance in corn to develop high oil yielding varieties.

Develop winter cereals for southern region grain-silage-pasture production.

Genetic and environmental control of biochemical constituents of alfalfa needs to be intensified.

Accelerate development of alfalfa varieties with resistance to disease and insects.

Develop rhizomatous and creeping-rooted alfalfas that are drought resistant and adapted to grazing.

Identify factors in alfalfa that promote animal growth and reproduction.

Develop an understanding of chemical factors that contribute to pigment retention in plants.

Determine principles of sterility as a basis for developing superior hybrid forages.

Breed a special purpose legume for western rangeland.

Study opportunity to transfer desirable genes or gene complexes interspecifically in Trifoliums.

Develop more vigorous long-lived varieties of the non-bloat legumes.

Develop basic knowledge on physical-chemical properties of grass as it affects palatability and forage quality.

Cultural Problems

Study problems associated with stubble mulch farming and minimum tillage.

Determine mechanism and reactions of plant growth and diagnostic techniques for salt-afflicted soil.

Improve techniques for seeding stand establishment and management of western arid range lands.

Determine seed potential and the relative effect of environment and management on seed production of grasses and legumes.

Initiate studies of plant growth requirements in relation to environmental stress.

Find cause and develop means of eliminating dark color bran of Belle Patna second-growth rice.

Develop methods to eliminate tendency to increase incidence of red rice.

Develop standards for isolation requirements in cross-pollinated forages grown for seed production.

Diseases

Study stalk rot and associated lodging in corn and soybeans.

Develop means of reducing the damage caused by smut in rice.

Continue research efforts on blast disease in rice with continued emphasis on new varieties and maintenance of seed stocks of hoja blanca resistant varieties.

Increase efforts on disease resistant oat varieties.

Investigate the cause of root rots and snow mold in wheat.

Intensify basic work on epidemiology of cereal rusts.

Intensify search for useful germplasm on a broad front, including plant introduction, cultivated forms, introduction of mutations and other agronomic characteristics of cereals.

Identify causal agents, host-pathogen relationships, distribution, prevalence of pathogens and means of controlling plant diseases.

Develop control measures for virus, foliar and root-rot diseases of grasses.

Varietal Evaluation

Expand variety evaluation for superior parental lines for development of new wheat hybrids.

Develop new rice varieties that will germinate and grow in cold water.

Determine the malting quality of new barley varieties.

Determine blends of the various varieties of grass for turf plantings.

Continue search of world habitats for adapted crop varieties for resistance to disease and insects.

Test and determine the adaptability of cool-season perennial grasses for the southern region.

Improve western range grasses for superior characteristics of salt tolerance, seedling vigor, seed quality and persistence.

Select improved Bermuda grass for southern states.

Weed Control

The current research activity in weed control for cereal and forage crops was approved as presented by the Committee. It believes that work should be continued on:

Witchweed, weed grasses and broadleaved weeds in rice, and on wild oats and dodder in alfalfa.

Development of preplanting methods of controlling weeds in combination with seed bed preparation techniques in grasses and legumes grown for seed.

Control of woody plants on rangelands and weeds in small grains with herbicides.

Because of the increased usage of herbicides, the Committee suggests that a more intensive investigation of their residual effects be undertaken; e.g., what may be the effects of residues on subsequent crops, and how long may certain residues remain in sufficient concentration in soils to influence subsequent crops.

More knowledge is needed regarding the influence of herbicides on treated plants, such as yield, nutrition influence, etc. Expanded basic research also is needed to develop more selective and efficient chemical methods of controlling weeds in cereal crops and forages We approve the program of work at the new radiation and metabolism laboratory to study accumulation, metabolism, and fate of herbicides in cereal and forage plants.

In connection with the problem of forage seed decline, it is suggested that emphasis be shifted from the currently heavily weighted categories to weed control work in forage seed crops.

Factors influencing germination of certain weed seeds should be investigated as a possible approach to controlling the germination of these weed seeds at an optimum time Particularly, the Committee wishes to call attention to the problem of wild oats and the need to stimulate germination of the majority of these seeds at a time which can be predetermined.

Nematode Control

The problem of nematodes and their attack on important cereal and forage crops is increasing in importance. The Committee views with concern the nominal amount of man-year effort being assigned to this problem.

It may be that sufficient work in these fields is being carried on at State Experiment Stations. Should this not be the case, the Committee suggests that if at all possible at least one or two additional scientists be assigned to this work. Continued research in the basic physiology and ecology of the nematodes attacking cereal and forage crops is needed in order to work out successful controls. Also, effort should be intensified in the breeding program to develop resistant varieties. Continued investigation of more effective and economical nematocides and methods of biological control is needed.

Basic work is needed to explore (1) the relationship of nematodes to cereal crops, (2) the species of nematodes important in forage crops growth and their effect in pasture mixtures and pasture rotations, and (3) nematode host-parasite relationships.

Insect Control

Work on the control of insects affecting cereal and forage crops is progressing on a broad front. The Committee commends the Department's action in partially reorienting the program of research on pest-control to avoid or minimize hazards from residues. It suggests that work be continued on:

Biology, ecology, and control of the cereal leaf beetle.

Determination of and control of insect vectors of corn stunt.

Development of safe and effective methods of control for sorghum midge.

Improvement of methods of control of insects attacking rice.

Methods for the control of the alfalfa weevil and chalcid fly, pests that are seriously affecting the economies of cereal, alfalfa, and seed production.

It has become more apparent that chemical methods of insect control are relatively short-lived due to the insects' ability to develop resistance to chemicals. Because of this, it becomes more important that research be directed more and more toward other approaches to control. Impressive among these are chemical attractants and the knowledge of how to synthesize them, the introduction and utilization of parasites and predators, and insect sterility. It is suggested that an investigation should be undertaken to learn if the nature of plant resistance is chemical and if plant resistance could be eventually determined and measured by chemical analysis. If such a relationship could be established, considerable savings could be realized in the screening of resistant varieties.

The development of resistant varieties should be continually explored through breeding programs and plant introductions. The Committee is pleased to learn of the effort in this regard in connection with the P.L. 480 program. Available information on insecticide residues indicates that additional information is needed in making sound control recommendations. Research should be initiated to determine the effect of environmental factors on residues and the residue effect on treated plants and the soil environment. As improved methods of analysis have been developed to measure residual quantities of insecticides, it has confused the control problem with particular reference to residual levels. What was once zero tolerance under old methodology may now be at an intolerable level under new methodology. Cooperative effort with all interested agencies and enforcement organizations to clarify this situation is recommended.

Production, Harvesting and Farm Storage Structures, Equipment and Methods

The Committee noted that several of its recommendations made last year were receiving emphasis in the list of activities of the Agricultural Engineering Research Division, and wishes to express its pleasure for this effort. In general, the research effort as outlined appeared to be directed toward several successful achievements; and, the Committee approves of the investigative studies under way. It is suggested that particular emphasis be placed upon the following:

Continued improvement in seed harvesting equipment.

Continued investigation of new and improved methods of treating of seed for increased germination.

Better methods of spray application in order to get better coverage with less material and reduce residue hazards.

Besides mechanical improvements in field pelleting, studies should be continued to evaluate the comparative economies between field pelleting of forages and other methods of handling roughages.

Various methods of application of fertilizers, herbicides, and seed planting as well as combinations of these have been developed around the country. The Department might direct its efforts to pull together these developments and centralize improvement in this field.

NUTRITION, CONSUMER AND INDUSTRIAL USE RESEARCH

For the past four years, grain advisory committees have recommended studies to determine the overall nutritional value to humans of wheat and have recommended use of P.L. 480 funds for this purpose. The Food and Nutrition Board of the National Research Council on two occasions has made a similar recommendation to the Department, and has offered assistance in the planning and implementation of such a study. In view of the world's food needs and the substantial supplies of wheat that exist in this country, this would seem desirable from a strictly economic standpoint. A well-conceived study of the value of wheat protein in human nutrition is needed to guide the purchase of food by other countries for mass feeding, and in the case of particular mill fractions for the special purpose of satisfying the unique protein requirements of the very young. The Committee reiterates this recommendation and urges that such a study be given priority.

The Department is to be commended for the fundamental research being conducted on grains. Data on the chemistry and physical attributes of the many components of cereal grains are needed by the Department and by

industry not only for the solution of existing problems related to the use of grain but to furnish the background information needed to develop industrial uses. Therefore, the Committee feels strongly that expansion of this part of the Department's program on grains is vitally needed. Certain of the subject areas now under investigation, such as the identification of the carotenoid pigments of corn, the characterization of the proteins of wheat and rice may prove vital in establishing quality standards for end use, the lack of which have created marketing problems which have been emphasized by efforts to increase our export markets.

In selection of additional fundamental studies, or the reinforcement of existing studies, the Committee urges the Department to give priority to (1) areas of research for all grains and forage crops most likely to permit the development of specifications, and the breeding of new varieties most likely to assure quality for intended end use, (2) chemical reactions of components of grain such as derivatives of starches which may be required for the development of industrial uses, (3) fermentation mechanisms which use grains as substrate, and (4) exploration of grains of unique chemical composition, e.g., high amylose corn.

Programming computers are finding wide application in feed production. Their use could result in more economical feeds for the agricultural community. The full potential of their use depends upon accurate knowledge of the nutrient content and nutrient availability of grain and forage crops. It is urged that manpower be devoted to acquiring these data and to the development of computer programming of feed production.

The Committee also recognizes the need for a balance of applied and fundamental research and recognizes that applied research in certain areas need not wait upon completion of existing or projected fundamental research. Although it is probable that the cereal xanthates and xanthides may create a new use for wheat, because of economic considerations, utilization research with regard to wheat and rice should be directed mainly toward food uses, while industrial utilization research should be directed more toward feed grains.

The development of new food products and of new industrial products may go hand in hand. For example, high protein cereal foods may be produced by processes that also result in low-cost starch products or in fermentation products having industrial applications.

The success of bulgur encourages the development of more grain food items specifically designed to be acceptable to the dietary patterns of foreign nations, and the Committee urges an increase in this effort. Work such as the bread flavor research in progress should be continued and expanded to find methods which will increase the acceptability of existing grain foods in this country.

The Committee is pleased to learn that Congress has authorized the transfer of five million dollars of CCC funds for utilization research in the

current fiscal year. Because grains are the commodities in most abundant supply in this country, and therefore need the maximum amount of utilization research, it is hoped that a substantial portion of these extra funds will be used for cereal and feed grain utilization research.

Important benefits may be realized from a more complete knowledge of the biologically active components that determine the feed value of forages and feed grains. Understanding the factors responsible for palatability is likewise desirable. Such investigations should be extended to determine the nature and extent of the changes taking place during processing.

The Committee recommends continued and expanded investigation of dehydrated alfalfa to accomplish: (1) identification and evaluation of unidentified growth, health, and reproductive factors; (2) chemical and biological evaluation of pigmentation factors; (3) more knowledge of the basic components and their nutritional availability; (4) product improvement such as fiber digestability, elimination of negative effects of lignin, engineering research, and chemurgic utilization.

The Committee recommends work on the following problems relating to rice processing and products:

> Priority should be given to the completion and publication of the compilation of all known facts on the chemical and physical properties of rice. Research should continue on the layers of the rice kernel with emphasis on producing high protein fractions.
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> Further work should be done on new and improved coatings for milled rice and a satisfactory method devised for enriching rice so that nutrients will not be removed in the washing or cooking processes.
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> Research on improving the machines for the milling of rice is urgently needed, including information on the nature of the substance bonding the bran to the endosperm. New milling techniques should be thoroughly investigated Techniques for the parboiling of rice should be explored to enable the production of a light, nutritious product.
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> The development of high protein content rice flours and air classification, development of rice flours with special properties and development of special milling equipment for the removal of the protein content of surface layers of the endosperm should be investigated.
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> Work between laboratories having responsibility for rice research should be more closely coordinated with each laboratory working on subsamples from the same lot so that the findings will yield more useful information.

MARKETING RESEARCH

The Committee is in general agreement with plans outlined by the Department for continuing research to solve marketing problems related to grain and forage crops, seeds, feeds, and the multiple products derived therefrom. The Committee's position on the following specific marketing problems, not listed in any priority order, is definitely one of emphasis and/or re-emphasis.

Objective Measurements of Grain, Seed, and Forage Quality

The Committee is gratified to note that the Department plans to accelerate the current program for evaluating the performance of mechanical samplers and grain probes. All segments of the industry have repeatedly indicated the need for improvement in the methods now available for obtaining representative samples of grain at terminal markets or mill locations as well as at other pertinent points in the marketing channel.

The Committee recommends that research to develop new and improved methods, equipment, and techniques for objectively evaluating the quality of grains, grain products and seeds be expanded and pursued aggressively. New concepts relative to such measurements are needed. Effort should be directed toward minimizing human judgments in such evaluations. Such research efforts must recognize that different end use demands may call for different measures of quality for the same commodity. It also should be recognized that new and more specific detailed measurements of quality will be needed in the future.

Maintenance of Grain Quality During Storage

Additional research is needed on the chemical, physiological, and biochemical changes which occur in cereals during storage. Such studies should go beyond simple measurements of visible damage, and investigate the loss in feed or food values beyond those losses which can be measured by our present grading system for grains; e.g., the loss of xanthophyll in corn when held in storage for long periods.

Methods and Equipment for Handling, Storing and Transporting Grain, Seed, Forage Crops, and Feeds

The Committee commends the Department for the work that has been done to date on methods and equipment for handling grain, seed, forage crops, and feed that has resulted in reducing damage to these commodities to their present relatively low levels. This work has had at least one result, savings of millions of dollars to producers, handlers, processors, and consumers, because of increased market quality, no matter how such quality is measured.

For the future, the Committee strongly recommends that:

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Work, on problems which have been investigated and solved to the point where widespread commercial acceptance of the answers is clearly evident, should be diminished with a clear mandate to all sectors of agri-business that future improvements should be made by those who stand to gain from such further refinements. An example might be work on the design and methods of operating grain aeration systems.

Work should be increased substantially on the problems of handling and transporting forage crops because of the economic significance of these crops to the Nation's agricultural producers, and the historical difficulties of handling and transporting bulky, low dollar unit value commodities. Such research, for example, should involve the pelleting process of these bulky items and the physiochemical changes that occur as a result of pelleting.

Work should be continued, and increased or initiated, on those problems where there is definite evidence that significant economic loss is being suffered by any segment of American agribusiness because of loss of quality or quantity in handling, storing, and transporting grain, seed, and forage crops, and feeds.

The Department should give immediate and sustained attention to the development of entirely new concepts in methods and equipment for handling, storing, and transporting grains, forages, seeds, feeds, and the multiple products involved. For example, as a type of basic research, investigations should be made, in depth, of the economic and mechanical feasibility of transporting the above-mentioned commodities from certain points on the outskirts of major cities to central locations by means of pipelines, using either forced air or negative pressure systems.

Development of Control Methods for Insects Investing Stored and Packaged Grains, Food, Feed, Forage, and End Products Thereof

Insects, including those species which have recently appeared in this country and those susceptible of importation, seriously threaten our inventories of stored grain, feed, forage, food and end products. Recognizing the real dangers posed by these insects, it is recommended that study be made of them in their native habitats. The purpose of such study would be to develop controls for immediate use should the need arise. Use of P.L. 480 funds is indicated to the extent possible.

To cope with their many and complex insect problems, the grains, feed, forage, and end products industries require highly effective control measures that do not have objectionable odors or chemical residues. Basic and applied research should be expanded on (1) biology and ecology of pertinent insects, (2) development of improved chemical control methods that leave no undesirable odors or pesticide residues, (3) Development of non-chemical methods of insect control, and (4) development of insect-resistant packages specifically designed for the various affected commodities and end products in the marketing channels.

Insect infestation in stored seeds needs special attention. The treatments must not impair germination or leave harmful residues that will interfere with the disposal of surplus stocks as animal feeds. The Committee recommends intensive research on these important problems.

Studies in Foreign Countries

Establish, in selected foreign markets, laboratories staffed with competent scientists to analyze the quality of cereals, seeds, and forage products coming from all countries to identify quality deficiencies and quality products. The information should be continuously transmitted to United States producers and handlers of these products. These laboratories should also study the quality preferences and other quality trends in the markets where they are located, in an attempt to expand United States export outlets. This would include studies on varietal and other quality preferences in rice, class and grade preferences for wheat and other grains, etc. P.L. 480 funds should be used to the extent possible.

Tolerances and Statistics of Seed Testing

Because there is no practical method of testing for uniformity, international and domestic commerce in seeds is affected adversely. There is a need to develop a statistical method by which the uniformity or homogeneity of a seed lot can be determined with a minimum of testing. Sound statistical tolerances for germination and possibly a revision of other tolerances are highly desirable

Institutional Market for Cereal Products

Nearly one-fifth of the food dollar volume moves through institutional outlets; e.g., restaurants, hospitals, industrial food service, etc. It is estimated that the present rate of one meal out of four served in a public eating place will be increased in 10 years to one meal out of three. A basic study is needed to improve the efficiency of the marketing system by identifying and measuring this "Institutional" market for cereal products. This study should identify and measure the relative size of the various types of users in this market, and should attempt to determine the cereal products and associated services desired by these users.

Feed Plant and Equipment Design

The Committee recommends that no research time be spent on feed plant and equipment design. This field is being adequately covered by private industry and by consulting engineering firms. It is recommended that the Department establish a library and clearing house for such information and a listing of independent groups that can furnish these services to those who request it.

ECONOMIC RESEARCH

Constant and rapid changes in the factors affecting the economics of production, handling, processing and marketing of cereals, cereal products, seeds, feeds, and forage crops require a continuing appraisal of all segments of the industries represented. Artificial stimulation or curtailment of production and market outlets by such factors as import duties and export subsidies, or by national farm programs, are overriding factors that have important effects on the production and flow of agricultural products into domestic and world-consuming markets. Cost and price relationships and the other impacts of these unusual factors need objective evaluation.

The compiling and organization of statistics relative to the number of units of production, costs of production, and marketing and prices are essential to intelligent decision making in all segments of the industries represented. Since much of the success of such economic research is dependent on the cooperation of producers and industry people, care should be exercised to insure that the collection of data is handled so as to maintain the good will and cooperation of those supplying the information. The Committee urges that the analyses, reporting, and use of all information gathered from the industries involved be completely impartial and based on pure economics.

The following problems are of special interest and concern to the Committee:

> Studies on the effects on our agricultural economy of the various "closed" Trading Combines, such as the European Common Market, should be pursued aggressively. Emphasis should be placed on the study of those adjustments which should be made in our international trade practices to meet the export competition and the restrictive import policies of these new bargaining units. Emphasis also should be put on evaluating the effects of United States marketing practices on foreign trade to these and other areas.
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> More studies should be initiated on United States agricultural programs and their effects on both the short-range and long-range utilization of the agricultural products involved. The studies should concern themselves with the impacts and influences of

these programs on both the agricultural economy and the entire national economy. (Do certain of these programs discourage industries from allocating research funds for the development of new uses for grains in surplus?) These studies also should measure the relative area-to-area impacts of these programs on our agricultural economy; e.g., what shifts in production and processing of agricultural commodities are occurring as a result of these programs? The relationship of the Rural Area Development Program to this problem should be considered carefully.

Cost-of-production studies and studies on alternate opportunities in the use of land and other resources are needed by farmers so they can determine the most profitable crops to produce and methods to employ. However, the Committee feels that such studies can best be carried on by the various States.

Economic studies are needed to measure the effectiveness of past uses of P.L. 480 funds in the development of markets for grains, grain products, and forages in underdeveloped countries. These studies should try to determine how such funds can best be used to develop continuing trade in agricultural commodities with these countries over the long pull; e.g., what can we expect to export to these countries over the longer term to the benefit of both the United States and the importing country?

USDA research on new food and feed products should be limited to the development of the products and the evaluations of their market potentials. Studies on the problems of merchandising and promoting these products should be left to industry.

The largest single cost of marketing all agricultural commodities is transportation. The greatest opportunities for reducing these marketing costs lie in reducing transportation costs. To date, most transportation research in commodity marketing has been descriptive. This has been very useful as it describes commodity flow patterns, relative importance of various modes of transportation, and trends in each. There are several ways to effect savings in commodity transportation. One is to use alternative modes of transportation when they offer savings. This has occurred to a large degree as evidenced by increased use of trucks, barges, and lake vessels. A second way is to use more efficient equipment. Use of larger trucks, oversized barges, and covered hopper rail cars, both standard and jumbo, are examples. A third way to reduce costs is to reduce transportation rates. How these rate reductions are made is very controversial and needs adequate research. Agri-business has invested huge amounts of capital in facilities on the basis of expected transportation costs and practices. Some currently proposed legislation may drastically affect existing trade

practices. The end result of these transportation changes, and the effect they may have on the overall efficiency of grain, forage and seed crop and feed marketing, needs to be more fully understood.

It appears to the Committee that having completed considerable descriptive research and some equipment research, the next step is to analyze alternatives to further reducing overall costs. The Committee strongly recommends the initiation of immediate projects to analyze alternatives that might further reduce overall transportation costs. Research is needed which would break down the costs of performing each function by the carriers. Further research also is needed to allow intelligent appraisal of which of these services are essential, which could be dropped, and which could be performed more efficiently by the present users of these services rather than by the carriers.

The Committee recognizes an urgent need for a complete study of food consumption habits and consumer preferences in foods. The urgency of this need was pointed out by most of the industry and producer groups appearing before the Committee. Such a study should measure consumer attitudes toward the various cereals and substitutable products, the factors that may cause consumers to buy one product in preference to another, what "fads" have an influence on buying decisions, in what form and other information pertaining to how consumers make their food buying decisions. It also should bring up-to-date the statistics on what consumers actually are buying. Such a study should cover all the food cereals.

The importance and benefits of agricultural cooperatives to a healthy agriculture are understood and appreciated by the Committee. Research done in the past by the Farmer Cooperative Service and its predecessor organizations has contributed materially to the economic advancement of agricultural producers. Today, many patron-owned agricultural cooperatives have attained the same stature in the market place as major investor-owned agri-business groups. Therefore, the Committee believes that further cooperative research by USDA should be directed toward those cooperative efforts where there still is a need for assistance on the part of the cooperative, in order to organize, exist, and compete with other segments of industry.

Domestic supply, demand and price statistics compiled by the USDA should be strengthened and more pertinent analyses of these statistics should be made by the Department. Continuing efforts should be made, through research, to improve the accuracy of crop production and inventory stocks estimates.

The Committee recommends that the Department initiate a study to determine the problems that would be involved in publishing all statistical data for grains on both a bushel basis and a hundred-weight basis. The purpose of this study would be to measure the problems that could be encountered in switching completely to a hundred-weight basis sometime in the future. Research should also be initiated to evaluate the probable impacts on the entire grain economy of a shift from trading on a bushel basis to trading on a hundred-weight basis. Information obtained in previous studies needs to be updated.

The Committee recommends that more emphasis be placed on the gathering, analyzing, and publishing of pertinent statistics on the world supply and demand for our principal grain, forage, and seed crops and their end-products. This information should be developed for each of the important producing and consuming countries.